

## Timing Subcommittee Report Summary

### Effects of a GPS Interruption on U.S. Wireline and Wireless Telecommunications Networks

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This report will include a brief tutorial of how a telecommunications carrier uses the GPS timing signal to discipline its network. It will show how a large carrier partitions its signalling and information networks. The effect, on various services, of a generic timing degradation will be described. The effect of a GPS interruption on wireline and wireless networks and other services will be briefly described.

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# EFFECTS of a GPS INTERRUPTION ON U.S. WIRELINE and WIRELESS TELECOMMUNICATIONS NETWORKS

Ed Butterline

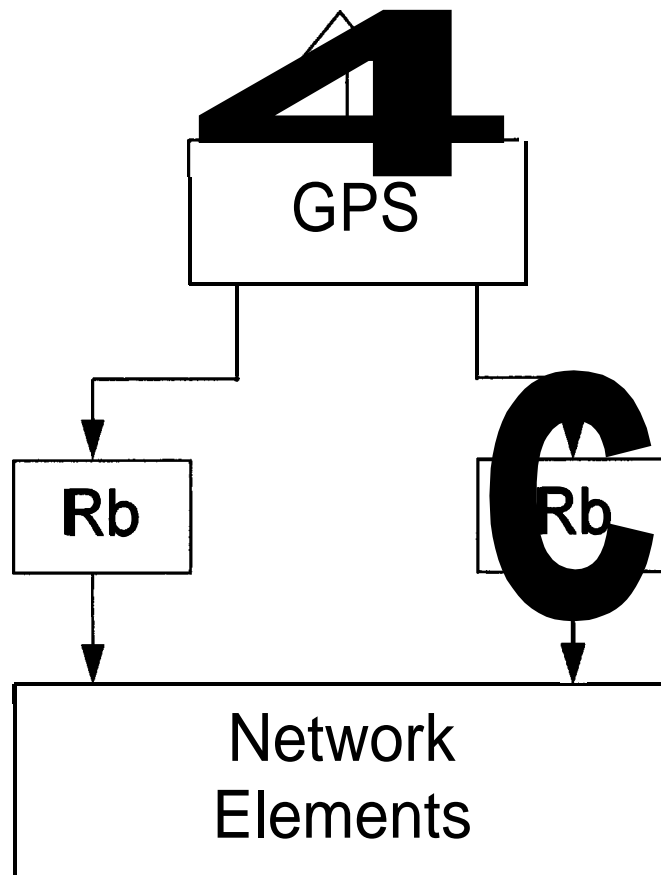
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# TIMING DISTRIBUTION INTRA-OFFICE

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# INFORMATION TRANSMISSION

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- The Basic Transmission Unit - 1.544 Mbs or a TI
- TI equals 24 voice services
- A TI is transmitted in 193 bit blocks  
24 8 bit voice circuits plus 1 sync bit
- Services/circuits are timing buffered

# TIMING IMPAIRMENTS (SLIPS)

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- Occur when the receive clock is running faster or slower than the transmit clock
- Results in a repetition or deletion of an 8 bit byte

# EFFECTS OF SLIPS ON TELECOMMUNICATION SERVICES

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- Voice - Noise
- Fax - Loss of picture content
- Data - Re-transmission
- Video - Freeze frame
- Encryption - Re-transmit key code

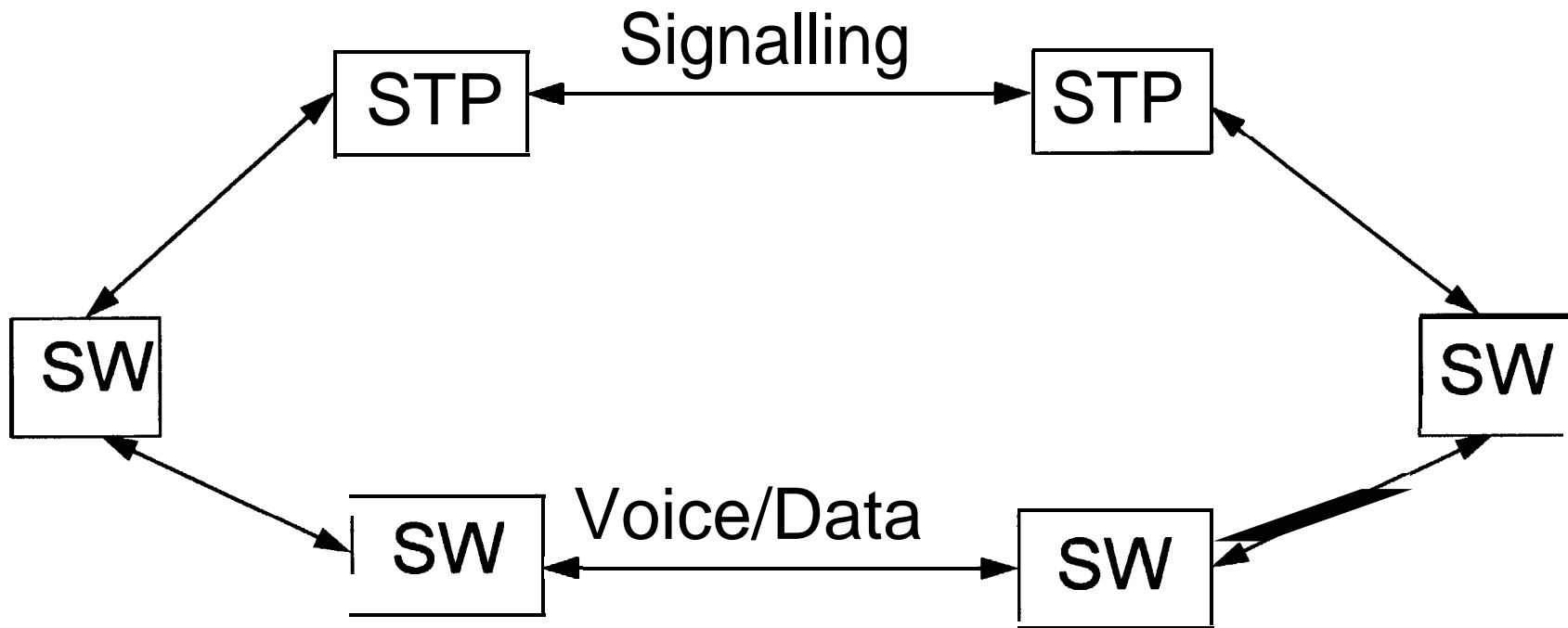
# TELEPHONE SIGNALLING. NETWORK

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- The signalling network is partitioned from the transmission network
- It is encrypted

# TELEPHONE NETWORK

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# EFFECT OF PARTIAL GPS CONSTELLATION AVAILABILITY

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- No Effect

# EFFECT OF TOTAL GPS CONSTELLATION FAILURE

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- One week to one month - No effect
- After one month - Slips start occurring and increase in frequency
- As time goes on the public telephone network will fail due to an inability to signal

# WIRELINE NETWORK SUMMARY

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- A partial constellation failure would not be noticeable
- A total constellation failure would slowly degrade the network starting in about one month
- At time goes on, there would be geographic blackouts until the entire network failed due to signalling failure

# WIRELESS NETWORKS

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- CDMA
- GSM/TDMA

# CDMA

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- Uses the GPS time scale
- GPS receivers with low cost quartz oscillators at most nodes
- 1-3 days before the system has serious problems

# GSM/TDMA

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- Quartz based oscillators
- Dependent on **wireline** carriers
- Fairly tolerant
- Will probably work as long as the **wireline** network works

# MISCELLANEOUS SERVICES

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- Paging networks will fail quickly
- Voice over data networks ATM, etc.  
very uncertain, never tested
- Customer Provided Networks or Private  
networks probably an order of  
magnitude worse than the carrier they  
are connected to